# Evaluating Competitive Advantage of a New Product for Designing Successful Product Differentiation

July 13th 2010

## INCOSE2010

**Nobuaki MINATO, Assistant Professor**

**Naohiko KOHTAKE, Associate Professor**

Graduate School of System Design and Management, Keio University, Japan

- Introduction
  - Background of research
  - Purpose of research

- Competitive Advantage Matrix (CAM)
  - Tool Design origin
  - Visual framework
  - Process of Analysis

Purpose of

- Practical Application of CAM
  - Mitsubishi Regional Jet (MRJ)

- Conclusion

Background of research

- Q&A

Purpose of research

2

- Market-oriented product design has become more and more critical issue for business success today.

  - e.g. QMOLV, SPs?, Benchmarking, Strategic Canvas, OED etc.

several analytical tools/methodologies exist to design a differentiated product from market competitiveness... However, most of them do not properly consider the competitiveness of a product within 'market-oriented context', in other words, ignores how competitiveness of a new product changes in relation to the competition in the market

However, most of them do not properly consider the competitiveness of a product within 'market-oriented context', in other words, ignores how competitiveness of a new product changes in relation to the competition in the market
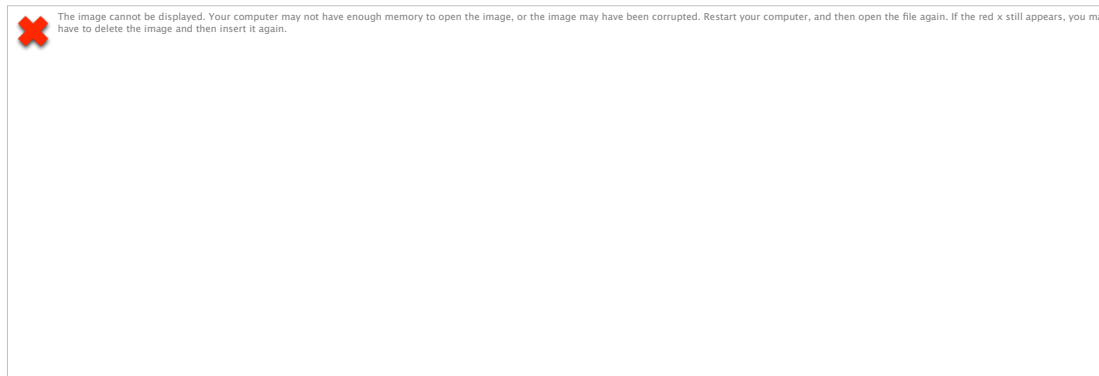
'Competitive Advantage Matrix' (CAM), to evaluate the degree of a product differentiation from the viewpoint of market competition

The CAM is effective especially in conceptualization phase of a new product design where actual feedback

Therefore, the author proposes an effective tool,

Competitive Advantage Matrix (CAM), by evaluating tools.

1. **Strategic Canvas** [Kim and Mauborgne, 2005] viewpoint of market competition

◹ # The CAM includes two functions based on the two tools.

1. **Strategic Canvas** [Kim and Mauborgne, 2005]
   ➢ For evaluating the degree of differentiation among products

2. **Pugh Selection** [Pugh, 1981]
   ➢ For considering importance of each criterion for decision making

❌ The image cannot be displayed. Your computer may not have enough memory to open the image, or the image may have been corrupted. Restart your computer, and then open the file again. If the red x still appears, you may have to delete the image and then insert it again.

**Example of Strategic Canvas, Created on Kim & Maubougne's Illustration (2005)**

| | **Weight** | Airplane | Train | | |
|---|---|---|---|---|---|
| | | 1*1=1 | 3*1=3 | 5*1=5 | 2*1=2 |
| Time | 5 | 5*5=25 | 2*5=10 | 1*5=5 | 2*5=10 |
| Quality | 3 | 2*3=6 | 5*3=15 | 1*3=3 | 4*3=12 |
| **Total Score** | | **32** | 28 | 13 | 24 |

**Example of Pugh Selection**

# Competitive Advantage Matrix (CAM)

SDM
System Design and Management

| [STEP 1] Target Market / [STEP 2] Competing Players / [STEP 3] Differentiation Factors | | [STEP 4] Weight — Importance in Market | [STEP 5] Player Evaluation | | | | | | [STEP 6] Average Calculation | | | [STEP 7] Analysis of Product F | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Segment Y | | | Segment Z | | | Segment Y Average | Segment Z Average | Market Average | v.s. A $(Fn-An)*Wn$ | v.s. Segt.Y $(Fn-Yn)*Wn$ | v.s. Market $(Fn-Mn)*Wn$ |
| | | | Product A | Product B | Product C | Product D | Product E | Product F | | | | | | |
| Technical Excellence | Factor 1 | **W1** | A1 | B1 | C1 | D1 | E1 | F1 | Y1 | Z1 | M1 | | | |
| | Factor 2 | **W2** | A2 | B2 | C2 | D2 | E2 | F2 | Y2 | Z2 | M2 | | | |
| Marketing Strength | Factor 3 | **W3** | A3 | B3 | C3 | D3 | E3 | F3 | Y3 | Z3 | M3 | | | |
| | Factor 4 | **W4** | A4 | B4 | C4 | D4 | E4 | F4 | Y4 | Z4 | M4 | | | |
| Social Acceptance | Factor 5 | **W5** | A5 | B5 | C5 | D5 | E5 | F5 | Y5 | Z5 | M5 | | | |
| | Factor 6 | **W6** | A6 | B6 | C6 | D6 | E6 | F6 | Y6 | Z6 | M6 | | | |
| **CODE** | | | **P1** | **P2** | **P3** | **P4** | **P5** | **P6** | **YA** | **ZA** | **MA** | **Competitive Advantage** | | |

Evaluation [ 5: Very Attractive, 4: Attractive, 3: Moderate, 2: Less Attractive, 1: Least Attractive]

Weighting  [ 5: Very Important, 4: Important, 3: Moderate, 2: Less Important, 1: Least Important]

☑ In CAM, a new product is analyzed from 3 aspects; (1) Technology Excellence, (2) Marketing Strength and (3) Social Acceptance.

STEP 1: Identify Target Market

STEP 2: Identify Players

STEP3: Identify Differentiation Factors

Technology Excellence | Marketing Strength | Social Acceptance

STEP4: Weighting Differentiation Factors

STEP 5: Scoring Identified Players

STEP 6: Calculate Average

STEP 7: Analyze Competitive Advantage

1. Identify target market to which your new product is expected to be delivered.

2. Identify competitors of your new product in the target market.

3. Identify characteristics that the competing products hold or expected to hold in the future, in terms of;

   • Technology Excellence
   • Marketing Strength
   • Social Acceptance

4. Evaluate importance of each differentiation factor in terms of market competition [1 to 5]

5. Evaluate attractiveness of each competing product against each differentiation factor [1 to 5]

6. Calculate the scores of market average and segment average.

7. Analyze the competitiveness of a new product in a target market/segment by comparing the scores.

7

# Equations

**[STEP 5]**
**Player Evaluation**

$$P1 = f(n) = \sum_{n=1}^{6} (Wn \times An)$$

$$P2 = f(n) = \sum_{n=1}^{6} (Wn \times Bn)$$

$$P3 = f(n) = \sum_{n=1}^{6} (Wn \times Cn)$$

$$P4 = f(n) = \sum_{n=1}^{6} (Wn \times Dn)$$

$$P5 = f(n) = \sum_{n=1}^{6} (Wn \times En)$$

$$P6 = f(n) = \sum_{n=1}^{6} (Wn \times Fn)$$

**[STEP 6]**
**Average Calculation**

$$Y1 = \frac{A1 + B1 + C1}{3}$$

$$Z1 = \frac{D1 + E1 + F1}{3}$$

$$M1 = \frac{A1 + B1 + C1 + D1 + E1 + F1}{6}$$

$$YA = f(n) = \sum_{n=1}^{6} Yn$$

$$ZA = f(n) = \sum_{n=1}^{6} Zn$$

$$MA = f(n) = \sum_{n=1}^{6} Mn$$

**[STEP 7]**
**Analysis of Product F**

$$\text{Competitiveness of } \textbf{Product F} \text{ against } \textbf{Product A} = f(n) = \sum_{n=1}^{6} \{(Fn - An) \times Wn\}$$

$$\text{Competitiveness of } \textbf{Product F} \text{ against } \textbf{Segment Z} = f(n) = \sum_{n=1}^{6} \{(Fn - Zn) \times Wn\}$$

$$\text{Competitiveness of } \textbf{Product F} \text{ against } \textbf{Market} = f(n) = \sum_{n=1}^{6} \{(Fn - Mn) \times Wn\}$$

| [STEP 3] Differentiation Factors / [STEP 2] Competing Players | | [STEP 1] Target Market — Importance in Market | [STEP 4] Weight | [STEP 5] Player Evaluation — Segment Y — Product A | Product B | Product C | Segment Z — Product D | Product E | Product F | [STEP 6] Average Calculation — Segment Y Average | Segment Z Average | Market Average | [STEP 7] Analysis of Product F — v.s. A (Fn-An)*Wn | v.s. Segt.Y (Fn-Yn)*Wn | v.s. Market (Fn-Mn)*Wn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Technical Excellence | Factor 1 | | **W1** | A1 | B1 | C1 | D1 | E1 | F1 | Y1 | Z1 | M1 | | | |
| | Factor 2 | | **W2** | A2 | B2 | C2 | D2 | E2 | F2 | Y2 | Z2 | M2 | | | |
| Marketing Strength | Factor 3 | | **W3** | A3 | B3 | C3 | D3 | E3 | F3 | Y3 | Z3 | | | | |
| | Factor 4 | | **W4** | A4 | B4 | C4 | D4 | E4 | F4 | Y4 | Z4 | M4 | | | |
| Social Acceptance | Factor 5 | | **W5** | A5 | B5 | C5 | D5 | E5 | F5 | Y5 | Z5 | M5 | | | |
| | Factor 6 | | **W6** | A6 | B6 | C6 | D6 | E6 | F6 | Y6 | Z6 | M6 | | | |
| **CODE** | | | | P1 | P2 | P3 | P4 | P5 | P6 | YA | ZA | MA | **Competitive Advantage** | | |

8

**Analyze New Market Entry of Mitsubishi Regional Jet (MRJ) to Japanese Regional Air Transport Market**

- Market domination by Bombardier (CRJ, DHC-8)
- Successful market entry by Embraer (ERJ)
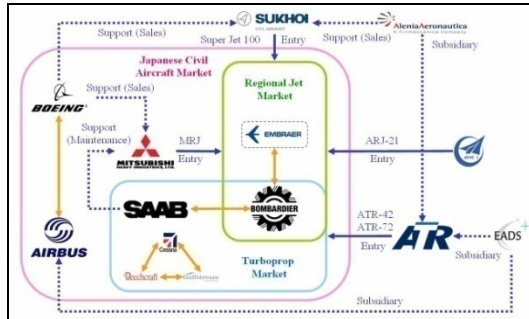- Potential competitors from Russian Sukhoi (Super Jet 100) and Chinese AVICI (ARJ-21)
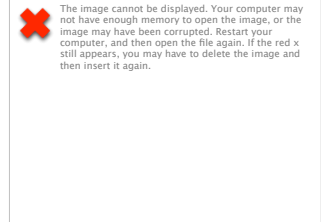
Mitsubishi Regional Jet
Source: MHI



Relations of Aircraft Manufacturing Companies in Japanese Market
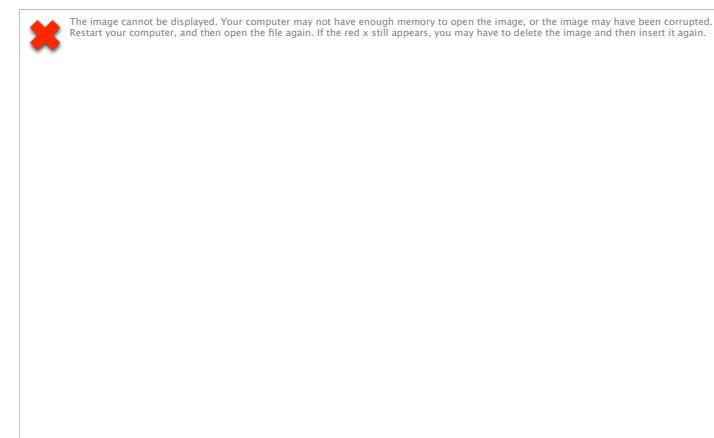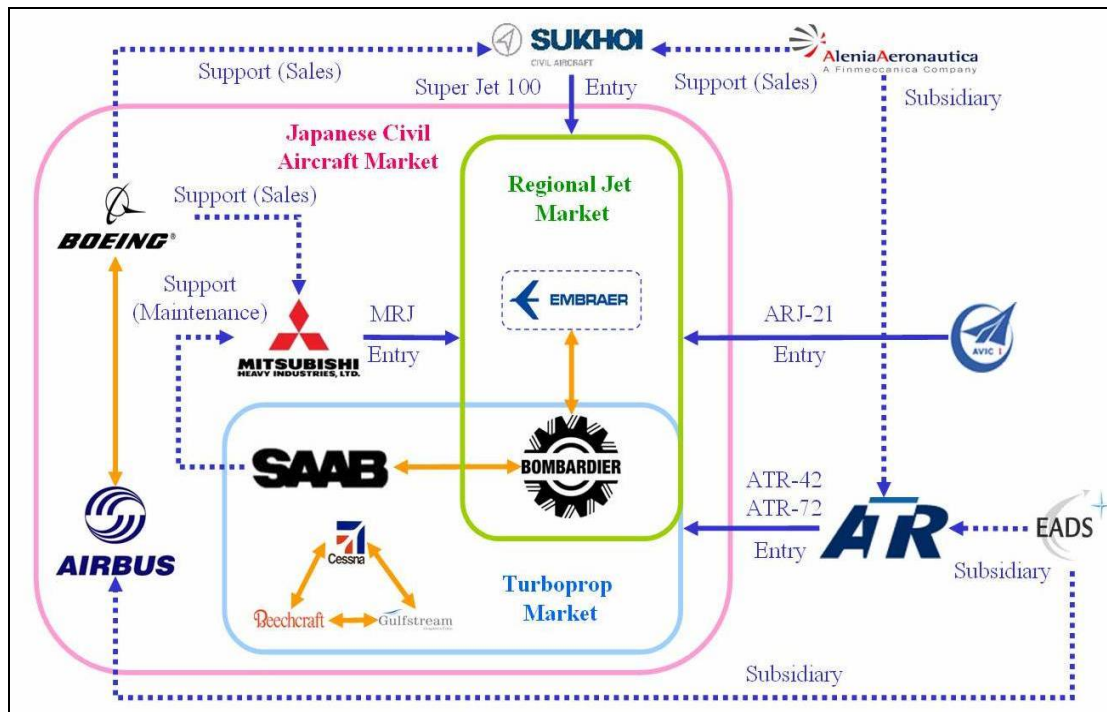
Number of Small-size Aircraft in Japan
(June 2007)

| | | Weight | Evaluation | | | | | | Average | | | Analysis | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **I** | **J** | **K** | **L** | **M** |
| | | | Turboprop (TP) | | | Regional Jet (RJ) | | | | | | v.s. Leader | v.s. Segt. | v.s. Market |
| | | Importance in Japanese Market | DHC-8 | SAAB | Fokker | CRJ | ERJ | MRJ | TP Segment | RJ Segment | Market | | (G-I)*A | (G-J)*A |
| Technical Excellence | STOL Capability | 3 | 3 | 5 | 5 | 2 | 2 | 3 | 4.3 | 2.3 | 3.3 | 0.0 | 2.0 | -1.0 |
| | Speed | 4 | 3 | 1 | 1 | 5 | 5 | 5 | 3.3 | 1.7 | 3.3 | 8.0 | 13.3 | 6.7 |
| | Comfort | 2 | 3 | 3 | 3 | 4 | 5 | 5 | 3.8 | 3.0 | 3.8 | 4.0 | 4.0 | 2.3 |
| | Cabin Quietness | 2 | 4 | 2 | 1 | 3 | 3 | 3 | 2.7 | 2.3 | 2.7 | -2.0 | 1.3 | 0.7 |
| | Commonality | 3 | 3 | 1 | 1 | 3 | 5 | 5 | 3.0 | 1.7 | 3.0 | 6.0 | 10.0 | 6.0 |
| | Fuel Consumption | 5 | 4 | 5 | 5 | 1 | 2 | 3 | 3.3 | 4.7 | 3.3 | -5.0 | -8.3 | -1.7 |
| | Maintenance Cost | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 3.0 | 4.0 | 3.0 | -8.0 | -8.0 | -4.0 |
| Marketing Strength | A/C Price | 5 | 3 | 5 | 5 | 2 | 1 | 1 | 2.8 | 4.3 | 2.8 | | -16.7 | -9.2 |
| | Product Variety | 3 | 5 | 1 | 1 | 5 | 5 | 2 | 3.2 | 2.3 | 3.2 | -9.0 | -1.0 | -3.5 |
| | Sales Channel | 5 | 5 | 3 | 1 | 5 | 5 | 5 | 4.0 | 3.0 | 4.0 | 0.0 | 10.0 | 5.0 |
| | Customer Support | 5 | 5 | 2 | 2 | 5 | 3 | 3 | 3.3 | 3.0 | 3.3 | -10.0 | 0.0 | -1.7 |
| | Brand Image | 3 | 1 | 3 | 1 | 1 | 3 | 3 | 2.0 | 1.7 | 2.0 | 6.0 | 4.0 | 3.0 |
| Social Acceptance | Air Pollution | 3 | 4 | 5 | 5 | 1 | 2 | 4 | 3.5 | 4.7 | 3.5 | 0.0 | -2.0 | 1.5 |
| | Safety Reliability | 5 | 1 | 5 | 5 | 1 | 5 | 3 | 3.3 | 3.7 | 3.3 | 10.0 | -3.3 | -1.7 |
| | Noise Level | 5 | 4 | 5 | 5 | 1 | 3 | 3 | 3.5 | 4.7 | 3.5 | -5.0 | -8.3 | -2.5 |
| Competitive Advantage of MRJ | | | | | | | | | | | | **-15.0** | **-3.0** | **0.0** |

Evaluation [ 5: Very Attractive, 4: Attractive, 3: Moderate, 2: Less Attractive, 1: Least Attractive]
Weighting [ 5: Very Important, 4: Important, 3: Moderate, 2: Less Important, 1: Least Important]

The proposed "Competitive Advantage Matrix (CAM)"is a matrix-based approach to evaluate competitive

a matrix-based approach to evaluate competitive advantage of a new product in a market-oriented context.

Mainly 3 benefits;

1. Provide systematic approach in product design
   - Multiple views (Competition against Market leader, Segment, Market)
   - Holistic views (Technical, Business, Social aspects)

- Scoring Process

  - Used a 'focus group' of the specialists in MRJ case but the result is somewhat subjective
  - Need to explore how to enhance objectivity and Scoring Process

- Used a 'focus group' of the specialists in MRJ case
  - Need to explore how to enhance objectivity and

    - Consumer products

- Further application and examination of the effectiveness of CAM on product design process

# Keio SDM

1. **KEIO is the _____** university in Japan, university in Japan, established in 1858

2. **KEIO SDM is the _____** school in KEIO established in 2008

3. **Educational Program** (Japanese or **English** )

   - ☐ Master (2 Years)
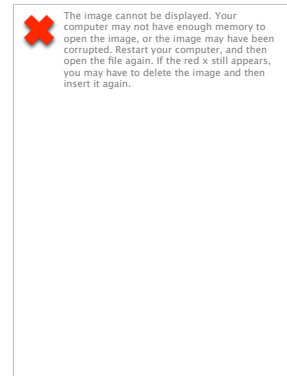     - ☐ PhD (3 Years)

   - **Faculty**
   - ☐ 12 (Tenured) + 16 (Non-tenured)
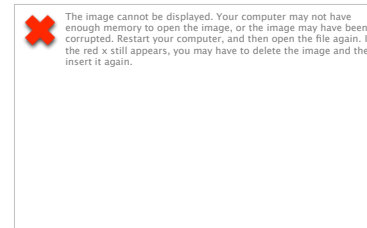
5. **Students** (Total 203, as of April 2010)
   - ☐ 143 Master Students
   - ☐ 60 PhD Students
   - ☐ 21 International Students

6. **Graduates** (Total 51, As of April 2010
   - ☐ Master: 49 Students

Yukichi Fukuzawa
Founder of Keio

Mita Campus          Hiyoshi Campus (SDM)
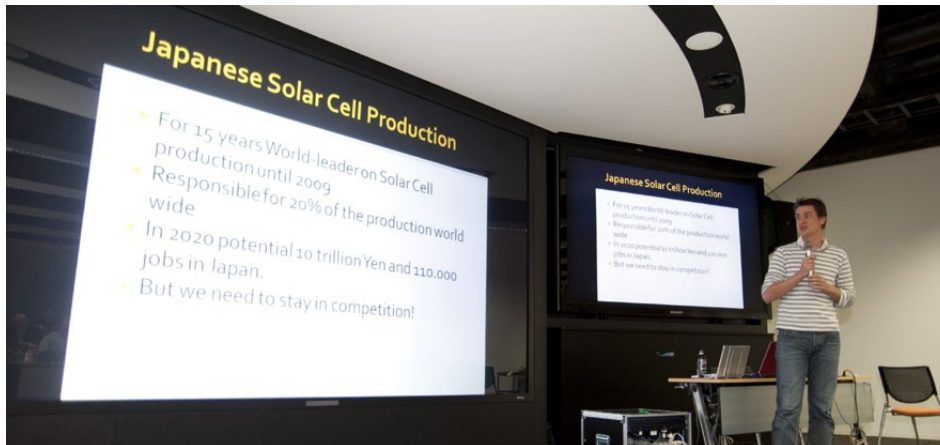
Keio SDM's first graduation (March 2010)

# Keio SDM



Active Learning Project Sequence (ALPS), Stanford, MIT, Keio SDM
"Safety and Security" (2010)



Guest Lecture by Prof. Dov Dory, MIT
"OPM (Object-Process Methodology)"



Intensive Lecture
by R. Halligan
"Requirement
Engineering"





Final Presentation by the students of Delft University of Technology
"Japanese Solar Cell Production" by Mr. Frank Pijnenborg

# Thank you.